in manuscript. Indeed, Dr. Wild would almost lay it down as a rule that unpublished observations should be deemed scientifically useless. As to congresses, he does not think that they should be occupied with discussions on the laws of meteorology. The derivation of laws from observations should be looked for in the undisturbed thoughtfulness of individuals. Experience shows, however, that private persons do not employ themselves as much as formerly in working out observations, and it seems to be absolutely necessary for the advancement of meteorology that every official observer should be given sufficient time, beyond that required for mechanical work, for developing the science as far as his powers will permit, and that the central institutions should be adequately endowed for this purpose.—The next paper is a review, by Dr. Hann, of the publications of Messrs. Fjord and Paul la Cour on the climate of Denmark, which contain very valuable statistics in the decennial means of fourteen stations. As in other similarly situated countries, both the heat of summer and the cold of winter are more intense inland than on the coasts, and in July the most easterly stations are the warmest. The mild weather of spring seems to advance from S.W. to N.E., and the cool weather of October from N.W. to S.E. Thus the mean temperature of 8° is reached in N.W. Jütland on the 11th, in Bornholm and the northern extremity of Rügen between the 23rd and 24th of October. The mean monthly range of temperature is greatest in May, least in January; from April to August the maxima rise higher above the monthly mean than the minima sink below it; from September to March the relation is converse. The absolute maximum range was registered in July, the absolute minimum in November. The average number of days on which frost occurs is ninety-two; time of maximum rainfall the latter end of August and beginning of September; of minimum, the beginning of April. Yearly mean rainfall—in Denmark, 604 mm.; on the west coast of Jütland, 670 mm.; at Copenhagen, 587 mm.; Bornholm, 580 mm.. A small table inserted here by Dr. Hann gives a great deal of information as to days on which rain fell, and on which thunderstorms, hailstorms, fog, and cloud occurred. January is the cloudiest, May and July are the least cloudy of months. Tables showing the frequency per cent. of the different winds and the monthly barometric pressure close Dr. Hann's summary of the valuable work under review.—In the Kleinere Mittheilungen, Dr. Gustav Hellmann states the chief results of his inquiries into the distribution of thunderstorms in Northern Germany. In general the annual mean number of thunderstorms in Germany increases from N.E. to S.W. It is least on the coasts of the Baltic, particularly in East Prussia greatest in the district of the Upper Rhine. On the eastern coast of the Baltic about twelve are observed in the year; on the western coast of the Baltic, sixteen; and on the coast of the North Sea, fifteen. Inland, the number averages twenty. They increase in number with increasing altitude, up to about 1,400 m., then decrease rapidly. Winter thunderstorms are much more common in Northern Germany than in Austria and Hungary.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 30.—"An Experiment on Electro-Magnetic Rotation." By W. Spottiswoode, M.A., Treas. and V.P.R.S.

The phenomena of the rotation of movable conductors, carrying currents, about lines of magnetic force, are well known. One form of experiment, commonly called the rotating spark, presents, beside the actual rotation, some peculiar features which do not appear to have been noticed in detail.

The spark, when carefully observed, is seen to assume a spiral form; and the spiral is right-handed or left-handed according to both the direction of the current and the magnetic polarity. This effect is particularly noticeable if the magnetic pole be inserted only a short distance beyond the ring. The discharge is then seen to spread itself out sheetwise on the ring in the direction in which rotation would take place. The edge of the sheet is in the form of a helix.

The object of the following observations is to bring out the character of this phenomenon by making it a principal instead of a secondary feature of the experiment.

The arrangement here described consisted in using the poles of an electro-magnet as the terminals of a discharge from an induction-coil, and in observing the effect on the form of the discharge caused by exciting the electro-magnet. For this purpose the movable poles were insulated from the main body of the magnet by interposing a sheet of ebonite thick enough to prevent the passage of the discharge. The discharge was then effected either in the open air or in a closed chamber. The latter was constructed of a short cylinder of glass, say 3 inches in length and 2 in diameter, having conical ends pointed inwards, so as to receive the poles of the magnet. The chamber was also furnished with a pipe and stop-cock for the purposes of exhaustion.

The discharge from an induction-coil taken in air or other gas at atmospheric pressure, consists, as is well known, primarily of the spark proper or bright line, irregular in form and instantaneous in duration. But beside this, when the primary wire is thick and the battery-current strong, the spark is enveloped in a bright cloud, or rather flame, which is capable of being thrown on one side, although not entirely detached from the spark by a current of air. This, when examined in a revolving mirror, is found to be subsequent in time to the spark proper, and may be considered to be due to the gas in the neighbourhood of the spark becoming sufficiently heated to conduct part of the discharge, and to the consequent combustion of any extraneous matter floating in the medium. Such a view is supported by the fact that the colour of this flame depends partly upon the nature of the gas in which the discharge takes place, and partly upon that of any volatilisable matter which may be introduced near the poles.

The exciting of the magnet produces upon the spark proper no appreciable effect; but as soon as the flame is submitted to its action it is spread out into a sheet, which arranges itself in a helicoid right-handed or left-handed according to the direction of the current and of the magnetic polarity in obedience to Ampère's law.

Effects substantially the same are produced whether the discharge be taken in gas at atmospheric or at a less pressure. But in the former case the helix has a lower, in the latter a steeper gradient; that is to say, in the former case it presents a greater, in the latter a less number of turns, for a given interval between the poles.

Various gases were tried—atmospheric air, carbonic acid, ether, chloroform, coal-gas, hydrogen. Of these the first two succeeded best. With air the illumination of the flame-sheet was rather greater; but with carbonic acid greater steadiness of position was obtained. With both ether and chloroform, occasional flashes, brilliantly illuminated, were seen; but some chemical action appeared to take place militating against the steady development of the flame-sheet. With coal-gas there was an inconvenient deposit of carbon upon the sides of the chamber. With hydrogen the cloud was not sufficiently developed.

The success which attended the experiment with air may possibly be partly due, as suggested above, to the combustion of the extraneous matter floating therein; and in fact the brilliancy and extent of the sheet may be increased by attaching a piece of metallic sodium to the negative terminal, or by causing a stream of any of the chlorides in powder, *e.g.*, of strontium, lithium, &c., to flow across the field of action.

When a piece of sodium (or better still of soda) is attached to one of the terminals, two effects may be noticed. When that terminal is negative the whole of the flame is bright yellow, showing that the sodium is not only detached but even carried across the field and deposited on the positive terminal. When, however, the terminal, to which the sodium is attached is positive, it is found that the flame, when observed through a red glass, appears yellow to a certain distance from the (positive) terminal to which the sodium is attached, but red beyond; and also that the pitch of the helix is less near the position than near the negative terminal. These effects may be attributed to the presence of metallic vapour evolved by the heat at the positive terminal, but not carried across the field as when the terminal in question is negative.

The following explanation of the phenomenon, from which the mathematical part is omitted, is due to Prof. Stokes. Supposing the magnetic field to be uniform, the lines of force will be straight lines from pole to pole. In such a condition everything being symmetrical no rotation would take place. But if through any local circumstance the path of the current be distorted and displaced, then each element will be subject to two forces, one tending to turn the current round the axis, the other tending to make it follow the shortest path so as to diminish the resistance.

And the general nature of the phenomenon may be described as follows:—"First, we have the bright spark of no sensible

duration which strikes nearly in a straight line between the terminals. This opens a path for a continuous discharge, which being nearly in a condition of equilibrium, though an untranslatable one, remains a short time without much change of place. Then it moves rapidly to its position of equilibrium, the surface which is its locus forming the sheet. Then it remains in its position of equilibrium during the greater part of the discharge, approaching the axis again as the discharge falls, so that its equilibrium position is not so far from the axis. Thus we see two bright curves corresponding to the two positions of approximate rest united by a less bright sheet, the first curve being nearly a straight line, and the second nearly a helix traced on a cylinder of which the former line is a generating line.

"It was noticed that the sheet projected a little beyond the helix. This may be explained by considering that at first the discharge is more powerful than can be maintained, so that the curve reaches a little beyond the distance that can be maintained."

The appearance of the discharge when viewed in a revolving mirror (except the projection beyond the sheet, the illumination of which was too feeble to be observed) confirmed the above remarks.

Linnean Society, April 6.—Prof. G. Busk, vice-president, in the chair.—S. P. Agar, the Rev. R. F. Clarke, W. R. Guilfoile, Prof. H. A. Nicholson, J. Scully, and W. Waterfield were elected Fellows of the Society.—Dr. Day exhibited a Kingfisher and Unio, the former having been drowned by closing of the valves of the latter.—Mr. E. M. Holmes laid before the Society some rare mosses obtained in Kent. The localities, &c., of *Anacalypta caespitosa*, *Seligeria paucifolia*, *Hypnum silesiacum*, *Dicranum montanum*, and *D. flagellare* were specially commented on.—Mr. Holmes also showed the root of *Thapsia garganica* var. *silphium*, which is said to possess a remarkable power of healing wounds; though a fatal root to horses and camels.—G. J. Romanes read an account of some new species, varieties, and monstrous forms of Medusæ (see p. 496).—Dr. Francis Day read a paper on some of the fishes of the Deccan, more particularly describing and critically treating of between fifty and sixty species, a few of which are new. Besides geographical range, questions of physiological import are touched on. He strongly recommends the "Masheer" (*Barbus tor*), to English pisiculturists as worthy of introduction into our rivers. This fish is well known, not only for the sport it affords the angler, but also for the excellence of the flavour of its flesh. It equals or even surpasses the salmon in size, but unlike the latter never enters salt water. It deposits its ova in the hill-streams. For these and other reasons he believes it well adapted for acclimatisation.—A second paper of Dr. Day's referred to the introduction of Trout and Tench into India. He stated it may now be concluded that the Loch Leven Trout (*Salmo levensis*), and the Tench (*Tinca vulgaris*), have bred there, and may prove an eventual success. A specimen of the Loch Leven trout reared in the Neilgherry waters was exhibited at the meeting. Its weight out of spirit 1¼ oz.; its greatest length 6½ inches. Mr. Thomas, of the Madras Civil Service, in 1863, and Dr. Day in 1866, each attempted but unsuccessfully to carry out and hatch Trout ova in India; it was reserved for Mr. McIvor a few years later to succeed. The latter, in 1873, wrote, "all our fish are breeding rapidly," &c. The above specimen was caught January 1876. Dr. Day moreover remarks "whether trout will permanently succeed in Hindostan has yet to be solved."—Mr. C. H. Wade read some notes on the venous system of birds. These contained observations relating to abnormalities in their distribution in certain of our British songsters.—Dr. G. E. Dobson communicated a paper of Dr. J. D. McDonald's, on a new genus of trematoda, and some new or little known parasitic hirudinei. Resemblances between these groups are traced, though these are merely indicative of a representative relationship or one of analogy.—A paper entitled notes on Lowe's MS. list of Webb's type shells from the Canaries (1829), and on the annotations thereon of D'Orbigny (1839), and Lowe (1860), by the Rev. R. B. Watson, was briefly noticed by the secretary.—The following technical contribution was taken as read: A list of marine shells (ninety-five in all) chiefly from the Solomon Islands, with descriptions of several new species, by E. A. Smith.

Chemical Society, April 6.—Prof. Abel, F.R.S., president, in the chair.—The first paper read was a preliminary notice on the action of sulphuric acid on naphthalene, by Dr. J. Stenhouse and Mr. C. E. Groves. From amongst the products of the reaction the authors have succeeded in isolating two new isomeric compounds, which they call naphthalene sulphones.—Three notes from the Laboratory of the Yorkshire College of Science were then communicated by Prof. T. E. Thorpe, namely, On the action of the copper zinc couple on potassium chlorate and perchlorate, by Mr. H. Eccles; On thallium chlorate, by Mr. J. Muir; and On the isometric relations of thallium, by Mr. Thorpe himself.—Finally, Dr. H. E. Armstrong read a paper on the nomenclature of the carbon compounds, the discussion of which was adjourned until the next ordinary meeting, which will be on Thursday, April 20.

Zoological Society, April 4.—Prof. Newton, F.R.S., vice-president, in the chair.—Mr. H. E. Dresser exhibited and made remarks on a specimen of a hybrid between the Black Grouse and Hazel Grouse, belonging to Mr. J. Flower, and supposed to have been obtained in Norway. It had been purchased in the flesh in the London market.—Prof. Newton exhibited and remarked upon a copy of a Dutch translation of Pliny, containing a figure of the Dodo (*Didus ineptus*) and belonging to the Rev. Richard Hooper, which seemed to be an earlier edition of the same work which was formerly in the possession of the late Mr. Broderip, and was described by him in the Society's "Transactions" (vol. iv., p. 183).—Mr. R. Bowdler Sharpe exhibited a specimen of the true Swedish *Surnia ulula*, obtained many years ago at Amesbury, in Wiltshire, being the first recorded British-killed example of this species.—M. A. H. Garrod read a paper in which he gave a description of the organs and some of the most important muscles of the Darter (*Plotus anhinga*), from specimens which were recently living in the Society's collection.—Mr. Edward R. Alston read a paper on the genus *Dasyprocta*, and gave a description of a new species from Central America, for which the name *Dasyprocta isthmica* was proposed. The geographical range and synonomy of the other Agoutis were reviewed; *D. punctata* of Central America was regarded as distinct from *D. azaræ* of South Brazil, and *D. variegata* was shown to extend into New Grenada. In all ten species of Agouti were recognised as distinct.—A paper by Mr. P. L. Sclater and Mr. O. Salvin was read, in which they gave descriptions of fifteen new species of birds from Bolivia. Amongst these was a singular new form belonging to the Tanagridæ proposed to be called *Malacothraupis dentata*.—A second paper by the same authors contained a revised list of the Neotropical Anatidæ.

Royal Microscopical Society, April 5.—Mr. H. C. Sorby, F.R.S., president, in the chair.—A paper by M. Rénard, of Louvain, "On some results from a microscopical study of the plutonic and stratified rocks of Belgium," was read and illustrated by some beautiful chromo-lithographs. The paper chiefly dealt with the question of temperature at which these rocks had been formed, and the conclusions deduced from the presence of crystals and fluid in the cavities assigned 307° Centigrade as the probable heat at that period. The chairman expressed his great satisfaction that by a totally different process of reasoning M. Rénard had arrived at results so near to those which he had himself reached some years ago.—A paper by M. Brock, "On a new slip for mounting opaque objects," was communicated to the meeting by Prof. Rupert Jones.—A paper by Dr. J. J. Woodward, "On the markings of *Navicula rhomboides*," was read to the meeting by the Secretary. It was illustrated by a series of photo-micrographs, which deservedly called forth the admiration of all who examined them.

Anthropological Institute, March 28.—Col. A. Lane-Fox in the chair.—Mr. R. B. Swinton, was elected a member.—Capt. H. Dillon exhibited a collection of flint implements and arrow-heads recently made by him in the neighbourhood of Dytchley, Oxon.—Mr. E. B. Tylor, F.R.S., read a paper on Japanese mythology. The legends current in Japan are derived from three sources. Part belong to imported Buddhism, part are taken from Chinese mythology, and the remainder, to the ethnological interest of which the present paper called attention, are of native Japanese origin. It contains nature-myths of remarkable clearness, but distinct in their features from those of India, Greece, &c. Thus the episode of the Land-forming-god, who springs from the *asi* or flag which binds together the new-found marshy coast-land of Japan, belongs to what is, in fact, geology expressed in mythic language. Again, the birth of the Sun-goddess, and her transference to the sky as Ruler of Heaven, is followed by a graphic story of the visit paid to her by her brother, who is no doubt the personified Wind or Tempest, as

he is described as mild and gentle when unprovoked, and always with tears in his eyes (*i.e.*, rain), but when resisted he bursts into uncontrollable fury, uprooting trees and devastating the world. Frightened with his violence, his sister, the Sun-goddess, retires into a cave in the sky, closing the entrance with a rock, and leaving the world in darkness. By the advice of the god of Thought, a fire is kindled and dances performed outside, and the sacred mirrors and pieces of cut paper (*go-hei*) which still form the furniture of a *Sin-to* temple, are displayed. The Sun peeps forth, and is then pulled out altogether, and the cave closed. The whole episode is evidently a mythic picture of the Sun hidden in tempest in the clouds as in a cavern, till she comes forth again to enlighten the world.—A paper on the term "Religion" was read by Mr. Distant. He said that the possession or non-possession of religion, and the nature of the religion possessed were usually made by our leading anthropologists tests of development in civilisation and culture. But accounts are often untrustworthy, and depend upon the bias of the inquirer. Also, "Religion" is an undefined term; scarcely two writers on culture agreeing on the subject. Indeed, some of the religious ideas of savages are found to be held by eminent men. A term required to be used, that was alike capable of being conceived and incapable of being misunderstood.—In the discussions Mr. Tatui Babo, Mr. Conway, Mr. Moggridge, Mr. Bouverie Pusey, Mr. Jeremiah, and others, took part.

Institution of Civil Engineers, March 28.—Mr. Geo. Rob. Stephenson, president, in the chair.—The first paper read was on sewage interception systems, or dry-sewage processes, by Mr. Gilbert R. Redgrave.—The second paper read was on the treatment of sewage by precipitation, by Mr. W. Shelford.

PARIS

Academy of Sciences, April 10.—Vice-Admiral Paris in the chair.—The following papers were read:—Experimental critique on the formation of sugar in the blood, or the function of physiological glycæmia, by M. Cl. Bernard.—Analytical solution of the problem of distribution in a magnet, by M. Jamin.—Vegetation of maize commenced in an atmosphere without carbonic acid, by M. Boussingault. The grain, germinating, produces a fertile atmosphere (*i.e.*, one containing carbon), in which, with aid of light, the leaves organise chlorophyll, and then amylaceous and saccharine matters.—Verbal observations on the same subject, by M. Pasteur.—Seventeenth note on the electric conductivity of substances that are mediocre conductors, by M. Du Moncel. The substances here studied are the stems of certain shrubs, and the human body. The conductivity of the former varies with the mode of application of the electrodes, the nature and thickness of the bark, and the season. The resistance of the human body between the wrists is estimated at 350 to 220 kilometres. But when the skin is dry, and at the commencement of an experiment, it may exceed 2,000 kilometres.—Experiments on the schistosity of rocks; geological consequences that may be deduced, by M. Daubrée. The geometrical arrangement of the leaves of crystalline masses and Jurassic layers above them in various central formations of the Alps (Mont Blanc), are explained, through experiment, as the effect of flow of a mass which was not completely solid.—Discussion of barometric curves continued from March 7 to 14, 1876; best process for comparing the course of the temperature and the pressure, by M. Sainte-Claire-Deville.—On the *trombe* of Heiltz-le-Maurupt (Marne), Feb. 20, 1876. Two persons witness that the *trombe* descended; the windows of the town-hall were broken inwards, which is against the suction-hypothesis, as is also the fact that the circle of mechanical action was very distinctly circumscribed.—On the displacement of lines in the spectra of stars, produced by their movement in space (continued), by P. Secchi.—M. Borchardt was elected correspondent of the Academy in the section of geometry, in place of M. le Besgue.—Velocity of thermal flow in a bar of iron (second part), by M. Decharme.—On the solar spots and the physical constitution of the sun, by M. Planté. A horizontal sheet of filter paper, moistened with salt water, is connected above with the negative pole of the secondary battery; on bringing up towards it from below the positive electrode, a crater-like cavity is formed with torn edges projecting towards the + electrode (light and vapour also being emitted); and the aspect is very much that of sun-spots. M. Planté also studied the incandescent globules obtained in fusing thick metallic wires with a strong electric current of quantity, and draws a parallel between their structure and that of the sun.—Influence of the asparagine contained in saccharine juices (of beet and cane) on the saccharimetric test; destruction of the rotatory power of asparagine; method of determination, by MM. Champion and Pellet.—The elephants of Mount Dol; attempt at organogeny of the system of molar teeth of the mammoth (second communication), by M. Sirodot.—On the optical effects of lamellar snows floating horizontally, by M. De Fonvielle.—On the catastrophe of Grand Sable (district of Salazie) in the Isle of Reunion; second note by M. Vinson. He endeavours to show it was the work of subterranean fire, which prepared a normal eruption that followed.—Letter from M. Cassien on the same subject; he rejects the idea of volcanic action.—On the catastrophe of the Jabin pits (Feb. 4, 1876), by M. Riembault. Fine coal-powder, suspended in air, is explosive. In the Jabin pits a little fire-damp was probably first inflamed at a point, and this ignited the coal-powder, which, under high temperature, liberates its explosible gases. The galleries were found incrusted with coke, evidently the result of combustion of coal. The air of the miner's lungs, forming part of the explosive atmosphere, is inflamed with it.—On the hatching of the winter egg of Phylloxera; note by M. Balbiani. He succeeded in observing a young Phylloxera (April 9) immediately after hatching. He regards it as a fourth specific form of the animal.—On a compensating balance wheel for mafline and other watches, by M. Winnerl.—On the theory of the proof plane, by M. Bouty.—Note on the coloured rings produced by pressure in gypsum, and on their connections with the coefficients of elasticity, by M. Janettaz.—On the employment of Gramme's magneto-electric machines for lighting the large halls of railway stations, by M. Sartiaux.—Simple apparatus for the analysis of gaseous mixtures by means of absorbent liquids, by M. Raoult.—On exchange of ammonia between natural waters and the atmosphere, by M. Schloesing.—On the products of reduction of anethol, and on the probable constitution of this substance, by M. Landolph.—On change of the volume of organs in its relations to circulation of the blood, by M. Franck.—Researches on the functions of the spleen, by MM. Malassez and Picard. Iron appears to be, in the spleen, purely and simply in the state of hæmoglobin the same as that of the blood.—The physiological relations between the acoustic nerve and the motor apparatus of the eye, by M. Cyon.—On the embryology of Nemertina, by M. Barrois.—Osteological characters; observations on the persistence of the intermaxillary in man, by M. Roujou.—Action of sulphide of carbon on an insect which attacks the plants of herbaria, by M. Schnetzler.

BOOKS RECEIVED

BRITISH.—Geological Sketches: L. Agassiz (Trübner and Co.)—The Secret of the Circle, its Area ascertained: Alick Carrick (Henry Sotheran and Co.)—The Intellectual Development of Europe: J. W. Draper. 2 vols. (George Bell and Sons).—Sport in Abyssinia: Earl of Mayo (John Murray).—The Year-Book of Facts, 1876: C. Vincent (Ward, Lock, and Tyler).—Animals and Plants under Domestication, 2nd edition: Charles Darwin. 2 vols. (John Murray).—Vital Motion as a Mode of Physical Motion: Dr. Radcliffe (Macmillan and Co.)—Philosophy without Assumptions: T. P. Kirkman, F.R.S. (Longmans)—Diseases of the Nose: Spencer Watson, F.R.C.S. (H. K. Lewis).—Discoveries in New Guinea: Capt. John Moresby (John Murray).—Problems and Examples in Physics, an Appendix to Ganot's Elementary Physics (Longmans).

CONTENTS